



# Bio Vet Innovator Magazine

(Fueling The Future of Science...)

Volume 3 (Issue 2) FEBRUARY 2026



World Science Day – 28<sup>th</sup> February

Popular Article

## Tharparkar Cattle: A Legacy of Adaptation Productivity and Endurance

Uttam Kumar Sahu\*, Brijesh Kumar, M. H. Khan, Manas Kumar Patra, Mayank Singh<sup>1</sup>

Division of Animal Reproduction,  
ICAR–Indian Veterinary Research Institute (IVRI),  
Izatnagar, Bareilly, Uttar Pradesh, India

\*Corresponding Author: [uttam33000@gmail.com](mailto:uttam33000@gmail.com)

DOI: <https://doi.org/10.5281/zenodo.18731809>

Received: February 17, 2026

Published: February 22, 2026

© All rights are reserved by Uttam Kumar Sahu

### Abstract:

Tharparkar cattle are a prominent indigenous *Bos indicus* breed originating from the arid and semi-arid regions of western Rajasthan, India. Formally registered with the National Bureau of Animal Genetic Resources (Accession No. INDIA\_CATTLE\_1700\_THARPARKAR\_03028), the breed has evolved under conditions of heat stress, water scarcity, and limited feed resources. This review synthesizes available scientific evidence on the origin, population status, production performance, reproductive characteristics, genetic diversity, and conservation framework of Tharparkar cattle. Organized herd evaluations report average lactation yields of approximately 2,200–2,350 kg over 300–330 days with milk fat content of 4–5%, demonstrating moderate but stable productivity under low-input systems. Reproductive parameters indicate acceptable fertility, including age at first calving between 40–62 months, gestation length of 280–287 days, and calving intervals generally within 400–450 days. Ultrasonographic and Doppler assessments confirm stable estrous cyclicity and functional luteal dynamics, reflecting physiological resilience under semi-arid environments. Molecular investigations reveal substantial within-breed genetic variability, supporting long-term adaptability and selection potential. Although historical census records documented approximately 146,000 animals in 1982, demographic decline due to crossbreeding pressures underscores the need for structured conservation strategies. Collectively, Tharparkar cattle represent a climate-resilient indigenous genetic resource with strategic importance for sustainable dairy production in arid ecosystems.

**Keywords:** Tharparkar cattle, Indigenous breed, Arid adaptation, Milk production, Genetic diversity, Climate resilience.

### Introduction:

Tharparkar cattle represent one of the prominent indigenous *Bos indicus* breeds adapted to the arid and semi-arid regions of north-western India, with their primary home tract located in the western

districts of Rajasthan, particularly Jaisalmer, Barmer, and Jodhpur, extending historically into the Thar Desert region of Sindh. The breed is formally registered with the National Bureau of Animal Genetic Resources under accession number (Accession No. INDIA\_CATTLE\_1700\_THARPARKAR\_03028), confirming its recognized genetic identity within India's indigenous livestock registry. The breed has been extensively evaluated under organized farm conditions for its production, reproduction, and genetic parameters, reflecting its importance in structured breeding programs and sustainable dairy systems. Studies on production traits indicate that both genetic and non-genetic factors significantly influence first lactation milk yield, lactation length, and associated performance parameters in Tharparkar cattle (Hussain et al., 2015; Choudhary et al., 2019; Kishore et al., 2016). Organized herd evaluations further demonstrate moderate but stable production potential, emphasizing its suitability for resource-limited environments (Mishra et al., 2017). Reproductive performance has also been systematically investigated, with genetic analyses highlighting heritable components of fertility-related traits under farm management conditions (Mishra et al., 2018). Recent advancements in physiological and hemodynamic assessment have provided deeper insights into uterine blood flow dynamics across estrous cycle in Tharparkar cows, strengthening understanding of reproductive efficiency at a functional level (Sahu, 2025; Sahu et al., 2026).



Fig. 1. Tharparkar cow



Fig. 2. Tharparkar cow reared at Cattle and Buffalo Farm, ICAR-IVRI, Izatnagar

From a molecular perspective, microsatellite analysis has confirmed substantial genetic variability within the breed (Sodhi et al., 2006), while genome-wide SNP discovery has further expanded knowledge of its genetic architecture and diversity (Bose, 2025). Improvement strategies focusing on lactation persistency have been proposed as effective selection tools to enhance production performance (George et al., 2021). Collectively, these investigations establish Tharparkar cattle as a genetically diverse, reproductively stable, and production-efficient indigenous breed. A comprehensive synthesis of available evidence is therefore essential to contextualize its adaptive capacity, productive potential, and future role in sustainable dairy development.

### Origin Native Tract and Population Status:

Tharparkar cattle originated in the arid tract of the Thar Desert, historically distributed across the present-day districts of western Rajasthan and adjoining regions of Sindh. The breed evolved under extreme climatic stress characterized by high ambient temperature, erratic rainfall, sparse vegetation, and seasonal feed scarcity. Such environmental selection pressure contributed to the development of a hardy dual-purpose animal capable of maintaining productive and reproductive functions under nutritional and thermal stress. The breed has long been maintained in organized herds as well as traditional pastoral systems, facilitating structured genetic evaluation over decades. Genetic characterization studies have confirmed that Tharparkar possesses substantial within-breed variability. Microsatellite-based analysis demonstrated appreciable allelic diversity and heterozygosity, supporting its status as a genetically rich indigenous resource (Sodhi et al., 2006). More recent genome-wide SNP discovery and diversity analysis further revealed novel polymorphic loci and reaffirmed the distinct genomic architecture of the breed (Bose, 2025). These findings are important because genetic diversity underpins long-term adaptability and selection response.



**Fig. 3. Tharparkar cow reared at Cattle and Buffalo Farm, ICAR-IVRI, Izatnagar**

Population dynamics of Tharparkar cattle have shown marked temporal variation influenced by breeding policies and crossbreeding interventions. Historical census data from 1982 documented approximately 146,000 Tharparkar cattle in India, including nearly 1,600 breeding bulls and about 68,200 breeding cows, reflecting the breed's substantial population during that period. Subsequent demographic assessments indicate a considerable decline in purebred numbers over time. It has been suggested that only about 25 percent of the original pure Tharparkar population may remain relative to earlier decades, primarily due to widespread crossbreeding and changing dairy production preferences (Kumar et al., 2021; Kumar et al., 2023). Despite these reductions, organized herd management and systematic performance recording have helped sustain ongoing conservation and genetic improvement efforts (Hussain et al., 2015; Choudhary et al., 2019). Nevertheless, its continued evaluation in organized farms and research institutions indicates sustained conservation interest and breeding relevance (George et al., 2021). Thus, the origin of Tharparkar in a climatically extreme ecosystem, combined with documented genetic variability and institutional herd management, establishes it as a well-defined indigenous breed with measurable demographic and genomic identity.

### **Production Performance:**

Tharparkar cattle are recognized as a moderate-yielding dual-purpose indigenous breed with stable performance under organized and field conditions. Records from institutional herds indicate total lactation yields ranging between approximately 2,200 and 2,350 kg, with an average lactation length of about 300–330 days, translating to a practical daily milk yield of nearly 6.5–7.5 kg under farm management systems (Mishra et al., 2017). However, broader field evaluations reveal considerable variability influenced by nutrition, management, and environmental stress, with lactation yields ranging from around 900 kg in poorly managed systems to more than 3,000 kg in well-managed animals. Consequently, daily milk production may vary from roughly 3 to 10 kg across production environments (George et al., 2021). Milk composition in Tharparkar cattle is comparatively rich, with reported fat percentages generally ranging between 4 and 5 percent, and in some cases higher under specific feeding regimes, enhancing its value for traditional dairy products (Hussain et al., 2015). Organized herd data further document 305-day milk yields of approximately 2,100 kg and highlight good lactation persistency, suggesting that selection for persistency could enhance lifetime productivity without compromising environmental adaptation (George et al., 2021). Beyond dairy performance, Tharparkar cattle retain functional draught capacity, providing reliable light to medium draft power for ploughing and carting in arid farming systems, thereby supporting mixed crop–livestock livelihoods in their native tract (Choudhary et al., 2017). Genetic and non-genetic analyses indicate moderate heritability for key production traits, demonstrating that systematic selection and improved management can yield measurable gains while preserving the breed's adaptive resilience (Hussain et al., 2015; Kishore et al., 2016).

## Reproductive Characteristics:

Tharparkar cattle exhibit moderate sexual maturity consistent with well-adapted *Bos indicus* breeds reared under semi-arid conditions. Age at first estrus or puberty generally ranges between approximately 20–22 months (600–670 days), though values vary with nutrition, season of birth, and herd management (Gahlot et al., 2001; Mishra et al., 2018). Age at first service typically falls between 22–28 months (660–850 days), with organized herd data frequently reporting values toward the lower end of this range under improved management systems (Gahlot et al., 2001).

Age at first calving (AFC) shows wider variation, ranging from about 40 to 62 months (1200–1876 days). Organized herd least-squares means include  $1769 \pm 30$  days, while earlier evaluations reported values approaching  $1876 \pm 41$  days, reflecting environmental and management influences (Mishra et al., 2018). Such variation highlights the combined genetic and non-genetic control of reproductive maturation in the breed. Gestation length in Tharparkar cattle generally ranges from 280 to 287 days, with representative organized herd means around  $281.6 \pm 0.4$  days, although isolated reports have documented values up to approximately 286.8 days (Mishra et al., 2018). Service period under farm conditions commonly varies between 118–150 days, and calving interval typically ranges from 400–450 days, indicating acceptable fertility under semi-arid production systems (Mishra et al., 2017; Mishra et al., 2018).



**Fig. 4. Estrus signs in Tharparkar cow**

Detailed ovarian physiology has been characterized through ultrasonographic and Doppler studies. The estrous cycle length averages  $20.50 \pm 0.30$  days, with a luteal phase duration of  $16.10 \pm 0.23$  days (Sahu et al., 2026). Follicular dynamics demonstrate an average of  $15.36 \pm 0.84$  small follicles ( $<5$  mm),  $1.81 \pm 0.33$  medium follicles (5–9 mm), and  $0.68 \pm 0.10$  large follicles ( $\geq 9$  mm) per cycle. The mean preovulatory

follicle diameter at ovulation measures approximately  $13.14 \pm 0.31$  mm (Sahu et al., 2026). Corpus luteum development reflects functional luteal competence, with CL size showing strong positive correlation with serum progesterone concentration ( $r = 0.86$ ,  $P < 0.05$ ), confirming endocrine stability during the luteal phase (Sahu et al., 2026). Ovum pick-up and follicular population studies further indicate that Tharparkar donors possess adequate antral follicle reserves consistent with *Bos indicus* physiology, with variable oocyte recovery depending on stimulation protocols, thereby supporting assisted reproductive applications (Donadkar et al., 2024). Overall, Tharparkar cattle demonstrate stable cyclicity, functional ovarian dynamics, acceptable fertility indices, and gestational parameters within the normal zebu range, reinforcing their reproductive adaptability under arid and semi-arid environmental conditions.

### **Adaptive Capacity and Durability:**

Tharparkar cattle are naturally adapted to the extreme conditions of the Thar Desert, including high temperatures, intense solar radiation, and seasonal feed scarcity. Their light coat colour aids heat reflection, while long-term environmental selection has shaped metabolic efficiency and survival under low-input systems. Physiological studies demonstrate stable estrous cyclicity and functional luteal activity under tropical conditions, confirming endocrine resilience during heat stress (Sahu, 2025; Sahu et al., 2026). Genetic investigations further reveal substantial within-breed variability and distinct genomic architecture, supporting long-term adaptability and selection potential (Sodhi et al., 2006; Bose, 2025). Field and organized herd evaluations consistently describe the breed as hardy, capable of maintaining productivity and reproductive function despite climatic and nutritional stress (Mishra et al., 2017). These traits collectively establish Tharparkar cattle as a climate-resilient indigenous genetic resource suited to arid and semi-arid production systems.

### **Conservation, Policy Support and Genetic Improvement:**

Conservation and genetic improvement of Tharparkar cattle operate within the broader national framework for indigenous bovine development in India. As a formally registered indigenous breed, Tharparkar is eligible for conservation and improvement support under national initiatives aimed at strengthening native germplasm resources. Programs such as the National Programme for Bovine Breeding and the National Mission on Bovine Productivity have historically focused on expanding artificial insemination coverage, strengthening semen production infrastructure, and improving genetic merit across indigenous breeds. More recently, the Rashtriya Gokul Mission has emphasized in situ conservation, establishment of indigenous breed farms, genomic selection initiatives, and strengthening of breed improvement infrastructure. While these schemes function at the indigenous breed level rather than targeting a single breed exclusively, Tharparkar benefits from structured recording, selective breeding, and germplasm conservation efforts under this national policy framework.

Breed characterization and registration are coordinated through the National Bureau of Animal

Genetic Resources, which recognizes Tharparkar as a distinct indigenous genetic resource. Scientific evaluations of production, reproduction, and genetic variability (Sodhi et al., 2006; Mishra et al., 2018; George et al., 2021; Bose, 2025) provide the empirical foundation necessary for integrating performance recording and genomic tools into improvement programs. Thus, conservation of Tharparkar cattle is embedded within India's broader indigenous breed development strategy, combining field-level performance evaluation with molecular characterization to ensure sustainable genetic advancement without compromising adaptive resilience.

### Future Perspectives and Conclusion:

Future improvement of Tharparkar cattle should combine systematic performance recording with modern genomic tools to enhance milk yield, lactation persistency, and reproductive efficiency while preserving adaptive strength. Emphasis on functional traits such as fertility stability, heat tolerance, and metabolic efficiency will be essential in the context of increasing climatic variability. Integration of advanced reproductive monitoring techniques can further refine breeding decisions and improve selection accuracy in elite animals. Overall, Tharparkar cattle represent a resilient indigenous genetic resource characterized by moderate but stable milk production, functional reproductive competence, and strong environmental adaptability. Sustained conservation efforts, structured selection programs, and balanced genetic advancement will be critical to ensuring long-term productivity and sustainability of the breed in arid and semi-arid dairy systems.

### References:

- Altaf Hussain, A. H., Gupta, A. K., Dash, S. K., Manoj, M., & Shahid Ahmad, S. A. (2015). Effect of non-genetic factors on first lactation production and reproduction traits in Tharparkar cattle.
- Bose, A. (2025). *Genome Wide Identification of Novel SNPs and Diversity Analysis in Tharparkar Cattle* (Doctoral dissertation, Indian Veterinary Research Institute).
- Choudhary, B. L., Datt, M., & Bhinchhar, B. K. (2017). Study of Lactation Length and Milk Yield of F1 (Tharparkar X Holstein Friesian) Crossbred Cow During Three Consecutive Lactation. *International Journal of Current Microbiology and Applied Sciences*, 6, 1264-1270.
- Choudhary, G., Pannu, U., Gahlot, G. C., & Meena, S. (2019). Effect of Genetic and Non-Genetic Factors on First Lactation Production Traits in Tharparkar Cattle. *Int. J. Curr. Microbiol. App. Sci*, 8(2), 2160-2164.
- Choudhary, Garima, et al. "Influence of genetic and non-genetic factors on production traits of Tharparkar cattle at organized farm." *International Journal of Livestock Research* 9.3 (2019): 148-156.
- George, L., Gupta, I. D., Nandhini, P. B., Verma, A., & Achankunju, J. P. (2021). Enhancement of production performance of Tharparkar cattle using lactation persistency as a selection

- tool. *Indian Journal of Animal Research*.
- Hussain, A., Gupta, A. K., Dash, S. K., Manoj, M., & Ahmad, S. (2015). Effect of non-genetic factors on first lactation production and reproduction traits in Tharparkar cattle. *Indian J Anim Res*, 49(4), 438-41.
- Kishore, K., Joshi, R. K., Kumar, P., & Pal, R. S. (2016). Genetic and non-genetic factors affecting some production traits in Tharparkar cattle. *Veterinary practitioner*, 17(1).
- Kumar, H., Panigrahi, M., Saravanan, K. A., Parida, S., Bhushan, B., Gaur, G. K., ... & Singh, R. K. (2021). SNPs with intermediate minor allele frequencies facilitate accurate breed assignment of Indian Tharparkar cattle. *Gene*, 777, 145473.
- Kumar, H., Panigrahi, M., Saravanan, K. A., Rajawat, D., Parida, S., Bhushan, B., ... & Singh, R. K. (2023). Genome-wide detection of copy number variations in Tharparkar cattle. *Animal biotechnology*, 34(2), 448-455.
- Mishra, G., Siddiqui, M. F., Ingle, V. S., & Meel, M. S. (2017). Studies on production performance of Tharparkar cattle at organised farm. *Intl J Livest Res*, 7, 54-62.
- Mishra, G., Siddiqui, M. F., Ingle, V. S., & Pal, R. S. (2018). Genetic analysis of reproductive traits of Tharparkar cattle at organized farms in Rajasthan. *Indian Journal of Animal Research*, 52(8), 1129-1133.
- Sahu, U. K. (2025). *Uterine haemodynamics, follicular-luteal attributes and developmental competence of OPU-derived oocytes in subclinical endometritic dairy cows* (Doctoral dissertation). Indian Veterinary Research Institute.
- Sahu, U. K., Kumar, B., Khan, M. H., Warghat, C., Singh, M., Chauhan, V. S., & Singh, G. (2026). Spectral Doppler assessment of middle uterine artery hemodynamics across the estrous cycle in Tharparkar cows. *Frontiers in Animal Science*, 7, 1740299. <https://doi.org/10.3389/fanim.2026.1740299>
- Sodhi, M., Mukesh, M., Prakash, B., Ahlawat, S. P. S., & Sobti, R. C. (2006). Microsatellite DNA typing for assessment of genetic variability in Tharparkar breed of Indian zebu (*Bos indicus*) cattle, a major breed of Rajasthan. *Journal of genetics*, 85(3), 165-170.